

REMARKS

The Present Invention and the Pending Claims

The present invention relates to a light-receiving element comprising a GaN group semiconductor material. Claims 2-7 are currently pending.

The Amendments to the Specification and Claims

The specification has been amended to replace the term "decades" with the more commonly used, but equivalent, term "tens of." The claims have been amended to more particularly point out and distinctly claim the present invention. In particular, claim 2 has been amended to remove the term "small" so as to recite that the claimed semiconductor light receiving element has a depletion layer formed under the electrode, which extends to cover an area around the electrode. Moreover, the elements of claim 2 have been labeled and reorganized solely to make the claim easier to read. The elements and scope of claim 2 have not changed. In addition, claims 8-12 have been canceled. No new matter has been added by way of these amendments.

Summary of the Office Action

The Office Action rejects claim 2 (and claims 3-7 dependent thereon) under 35 U.S.C. § 112, second paragraph, as allegedly indefinite. In addition, the rejection of claims 2-7 under 35 U.S.C. § 103(a) as allegedly obvious in view of Khan et al. (U.S. Patent No. 4,614,961) in combination with Nozaki (JP Patent No. 61-008979) has been maintained. Finally, claims 8-12 are rejected under 35 U.S.C. § 103(a) as obvious over Ohkubo (U.S. Patent No. 5,710,439) in view of Shibata et al. (U.S. Patent No. 6,121,127), Berger et al. (U.S. Patent No. 5,777,390), and Nozaki (JP Patent No. 61-008979). Reconsideration of these rejections is respectfully requested.

Discussion of the Indefiniteness Rejection

The Examiner indicates that the phrase "a small area around the electrode" in claim 2 is unclear. Specifically, the Examiner alleges that the recitation of "a small area" renders the claims indefinite because the metes and bounds of the patent protection desired are not clearly set forth. Claim 2 has been amended to remove the term "small," thereby rendering the indefiniteness rejection moot.

Discussion of the Obviousness Rejections of Claims 2-7

In response to applicants' previous response, the Examiner argues that the current claim language does not distinguish between the teachings of Khan et al. and the present invention, because the pending claims, as currently written, do not require that the light enters the surface side of the light receiving element. Applicants respectfully disagree with this contention.

Claim 2 recites that "the light receiving element is a Schottky barrier type light receiving element *in which light enters the depletion layer.*" The depletion layer is "formed under the electrode, which depletion layer extends to cover an area around the electrode from the side the electrode is formed." The electrode is "formed on one surface of the light receiving layer as a light receiving surface in such manner that light can enter the light receiving layer." Thus, claim 2 clearly indicates that the light to be detected is introduced into the depletion layer *from the element surface side.*

In contrast, in the detector disclosed by Khan et al., the light to be detected enters the depletion layer, which is the light receiving area, from the side opposite to the side of a Schottky electrode (i.e., from *the side opposite of the element*) (see Figure 1 of Khan et al.). In particular, Khan et al. discloses a UV detector **10** comprising a sapphire substrate **11**, a buffer layer **12**, an $\text{Al}_x\text{Ga}_{1-x}\text{N}$ layer **14**, and a Schottky barrier **15**, which are laminated together successively (see Figure 1). The Schottky barrier type light-receiving element of Khan et al. has a light-receiving area characterized by a depletion layer extending toward the semiconductor side on the semiconductor **14**/Schottky electrode **15** interface. As discussed above, in the detector of Khan et al., the light to be detected enters the depletion layer (i.e., the light-receiving area) from the side *opposite* to the side on which a Schottky electrode used to block the light is formed (i.e., from the side *opposite* from the element) (see Figure 1 of Khan et al.).

Accordingly, the light receiving element of the present invention and the detector of Khan et al. have different structures as compared to one another. Khan et al. does not provide any teaching or suggestion to provide a detector in which light enters a depletion layer *from the surface side of the element*, as required by the pending claims that define the present invention.

The Examiner concedes that Khan et al. does not teach or suggest the feature of the present invention, as recited in the pending claims, in which the total of boundary lines between areas of the light receiving surface covered with Schottky electrode and exposed areas is longer than the length of the outer periphery of the light receiving surface. However, the Examiner alleges that one of ordinary skill in the art would have looked to the teachings

of the Nozaki reference for this element in order to optimize the area needed to receive light and minimize the outer periphery. The Examiner makes similar allegations with respect to claims 3-7.

Nozaki et al. merely describes a heterojunction type photovoltaic device in which a first conductive polycrystalline silicon layer (12) and a second conductive microcrystalline silicon layer (13) are laminated together. Nozaki et al. does not teach or suggest the light receiving layer comprising a GaN group semiconductor or a Schottky barrier type light receiving element. Accordingly, one of ordinary skill in the art would not be motivated to look to Nozaki et al. to obtain a Schottky barrier type light receiving element comprising a light receiving layer such as that of the present invention.

Even if, for the sake of argument, the disclosures of Khan et al. and Nozaki et al. were combined, the obtained device would not result in the invention of pending claim 2. Neither reference, either alone or in combination, teaches or suggests the structure of the light-receiving element of the present invention, in which the light to be detected enters the depletion layer from the side the electrode is formed (i.e., the element *surface* side) (see Figure 4(a) of the specification). In the absence of a teaching or suggestion of all the elements of the present invention, the cited references cannot be said to render pending claim 2 obvious.

Claims 3-7 are directly or indirectly dependent on claim 2 and accordingly contain all of the elements of claim 2. The cited references do not render pending claims 3-7 obvious for the same reasons discussed above with respect to claim 2. Therefore, the present invention as defined by claims 2-7 is not obvious from the teachings of Khan et al. in view of Nozaki et al. and the obviousness rejection should be withdrawn.

Discussion of Obviousness Rejection of Claims 8-12


Insomuch as claims 8-12 have been canceled, the obviousness rejection pertaining to these claims is moot.

Conclusion

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

In re Appln. of Tadatomo et al.
Application No. 09/787,502

Respectfully submitted,



John Kilyk, Jr., Reg. No. 30,763
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

Date: April 11, 2003